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Long-Term Monitoring Sensor Network

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Abstract

Long-term monitoring (LTM) associated with subsurface contamination sites is an expensive endeavor across the Department of Energy (DOE) complex and elsewhere, often exceeding the costs of the remediation phase of a clean-up project. The primary contributors to LTM costs are associated with labor. Sample collection, storage, preparation, analysis, and reporting can add a significant financial burden to project expense when extended over many years. Development of unattended, *in situ* monitoring networks capable of providing quantitative data satisfactory to regulatory concerns has the potential to significantly reduce LTM costs. However, survival and dependable operation in a difficult environment is a common obstacle to widespread use across the DOE complex or elsewhere. Deploying almost any sensor in the subsurface for extended periods of time will expose it to chemical and microbial degradation. Over the time-scales required for *in situ* LTM, even the most advanced sensor systems may be rendered useless. Frequent replacement or servicing (cleaning) of sensors is expensive and labor intensive, offsetting most, if not all, of the cost savings realized with unattended, *in situ* sensors.

Applied Research Associates, Inc. is working to enable facile, remote monitoring of contaminants and other subsurface parameters over prolonged periods through the development of an advanced long-term monitoring sensor network. To meet this objective, three key elements will be developed, integrated together, and field tested under this program: (1) an anti-fouling sensor chamber that can accommodate a variety of chemical and physical measurement devices based on electrochemical, optical and other techniques; (2) two rapid, cost effective, and gentle means of emplacing sensor packages either at precise locations directly in the subsurface or in pre-existing monitoring wells; and (3) a web browser-based data acquisition and control system (Web-DACS) utilizing field-networked microprocessor-controlled smart sensors housed in anti-fouling sensor chambers. The monitoring network will be highly versatile and can be applied to a variety of subsurface sensing scenarios in different media. However, this project will focus on monitoring water quality parameters of pH, oxidation-reduction potential, conductivity, and temperature in groundwater. The system will be demonstrated beneath a coal pile run-off basin at the Savannah River Site (SRS).